

1. Module details

Module name

Advanced Digital Television Principles

Module duration

It is expected that students with the appropriate entry knowledge and skills will successfully complete this module in 36 – 40 hours.

Module code

NUE412

Discipline code

0703230

2. Module purpose

This module aims to provide students with the knowledge and skills to undertake appropriate approaches to repair electronic and electrical equipment.

3. Prerequisites

Communications Fundamentals NE039
Digital Electronics 2 NE180
Amplifiers 2 NE183
Digital Television Principles NUE411

4. Relationship to competency standards

This module provides part of the underpinning knowledge and skills in the ‘Evidence Guide’ of specific units of competency in the National Electrotechnology Training Package and provides similar support, where mapped, to equivalent units in the National Metals and Engineering Competency Standards. For details refer to the module to unit maps, available from EE-Oz Training Standards.

5. Content

Audio
- Audio Encoding
- Audio Masking
- Audio sub band encoding

Dolby AC-3

MPEG-2 System Layer
- PES Packet Construction
- Time Stamps
- Programme Clock Reference (PCR)
- Transport Packet Header
- Programme Specific Information (PSI)

Channel Encoding
- Forward Error Correction (FEC)
- - Bit Error Rate (BER)
- Puncturing

Interleaving.

Modulation
- Phase Shift Keying (PSK)
- Quadrature Amplitude Modulation (OAM)

	<ul style="list-style-type: none">- Orthogonal Frequency Division Multiplexing (OFDM)- Coded Orthogonal Frequency Division Multiplexing (COFDM) <p>Hierarchical Modulation.</p> <ul style="list-style-type: none">- Terrestrial Channel Encoder- Satellite Channel Encoder- Carrier to Noise Ratio (C/N) <p>Single Frequency Networks</p> <ul style="list-style-type: none">- Guard Interval- Megaframes
6. Assessment strategy	
Assessment methods	Assessment should be progressive reflecting a holistic approach to ensure the module purpose is met. To assist in ensuring validity, reliability and fairness assessment instruments should include practical exercises, assignments and written tests consisting of a number of item types, such as multiple choice, short answer and problem solving.
Conditions of assessment	Learning and assessment will take place in an environment that is conducive to a learner's development.
7. Learning outcome details	
Learning outcome 1	Describe the role of audio encoding in a digital broadcasting system.
Assessment criteria	<ol style="list-style-type: none">1.1 State the purpose of audio encoding in a digital broadcasting system.1.2 Describe the minimum requirements of the MPEG audio coding/compression standards.1.3 Describe the meaning of the term <i>audio masking</i>.1.4 State the name of two types of audio masking.1.5 State the method used to digitise audio signals prior to going into the MPEG/Dolby AC-3 audio encoder.1.6 State the sampling frequency rates supported by the MPEG encoding process.1.7 Describe the structure of the audio data packet.1.8 State typical bit rates for hi fi quality sound using MPEG Layer I, II, III/Dolby AC-3 audio encoding.

Learning outcome 2

Describe the components of the MPEG-2 system layer.

Assessment criteria

- 2.1 Describe the structure of a video packetised elementary stream.
- 2.2 Identify the components of a digital TV program elementary stream (PES).
- 2.3 Identify the components in a PES header.
- 2.4 Describe the structure of a MPEG-2 transport stream.
- 2.5 List the contents of an MPEG-2 transport packet header.
- 2.6 State the purpose of a packet identifier (PID) in a transport stream header.
- 2.7 List the roles of the following programme specific information (PSI): programme association table (PAT), programme map table (PMT), network information table (NIT), conditional access table (CAT).

Learning outcome 3

Describe the components of a digital television channel encoder.

Assessment criteria

- 3.1 Draw the block diagram of a channel encoder.
- 3.2 Describe the function of pseudo random bit scrambling (PRBS) circuitry.
- 3.3 Define the meanings of bit error rate and ratio (BER).
- 3.4 Classify a range of bit error rates as acceptable or unacceptable for optimum digital television usage.
- 3.5 State the function of the forward error correction (FEC) block.
- 3.6 Describe the role of the three layers in a forward error correction (FEC) block.
- 3.7 Outline the process of '*puncturing*' a code word.

Learning outcome 4

Demonstrate knowledge and skills related to the repair and diagnosis of equipment faults in digital television systems.

Assessment criteria

- 4.1 List three types of modulation used in digital video broadcasting.

- 4.2 Show how '*bits*' are assigned to different carrier phase angles in a quadrature phase-shift keying (QPSK) modulation system.
- 4.3 Outline the advantages of differential phase shift keying, (DPSK) carrier modulation.
- 4.4 Describe the principles of quadrature modulation and give examples of its use in digital television broadcasting.
- 4.5 Identify carrier modulation faults using a constellation diagram.
- 4.6 Describe how a large number of individual carriers are coded to produce coded orthogonal frequency division multiplexing (COFDM).
- 4.7 State the advantages of coded orthogonal frequency division multiplexing (COFDM) over quadrature amplitude modulation when used for terrestrial broadcasting.
- 4.8 Identify the number of carriers used in 2k and 8k COFDM modes and their individual symbol duration.
- 4.9 Demonstrate the correct set up procedures for a pair of transmitters for a single frequency network.
- 4.10 Demonstrate the correct operation of typical test equipment used in the measurement, diagnosis and analysis of digital video signals.
- 4.11 State the effects of impulse noise, multi-path reception and Doppler Shift on Digital Television signals.
- 4.12 Use appropriate test equipment to locate and diagnose faults in digital television equipment.

Learning outcome 5

Demonstrate basic knowledge of circuit blocks in satellite and terrestrial encoders.

Assessment criteria

- 5.1 Draw a block diagram of a terrestrial channel encoder.
- 5.2 Draw a block diagram of a satellite channel encoder.
- 5.3 Briefly describe the function of each block in a terrestrial encoder.
- 5.4 Briefly describe the function of each block in a satellite encoder.

8. Delivery of the module

Delivery strategy

- 5.5 Use test equipment to measure carrier to noise ratio (C/N).
- 5.6 Identify the effects of an excessive carrier to noise ratio.

Delivery strategies must be suitable for learning both theoretical and practical aspects described in the module purpose. It is considered that the most effective method to achieve this is by integration of theory and practice where students learn by experimentation, research and reports. It is recommended that learning and assessment be facilitated in a holistic manner that may require learning outcome sequence other than that indicated in the module.

Resource requirements

Resources should be sufficient for students to carry out learning activities on an individual basis.

Suggested Learning Resource:

Adequate and representative equipment such that learners can individually undertake appropriate approaches to repair electronic and electrical equipment.

Ibrahim, K.F. Television Receiver Principles. 2nd edition
Addison Wesley Longman Ltd ISBN 0-582-35631-8

Buscombe, C.G. Television & Video Systems. Operation, Maintenance, Troubleshooting and Repair. 2nd edition
Prentice Hall. ISBN 0-13-442088-8

AS4599 + EN300744

As 4933.1 – 2000

Digital Television-Requirements for Receivers
Part 1: VHF/UHF DVB-T television broadcasts.

Aprile, J & Humphris, R. Digital Television
Electronic Fault Information Library. January 2001

Where this module is used in an approved Traineeship or Apprenticeship program learners should be advised to obtain, where available, respective EE-Oz Training Standards¹ **User Guides** (these outline in detail what training and work performance the Learner is required to undertake for the program).

¹ EEQSBA – ElectroComms and EnergyUtilities Qualifications Standards Body of Australia Ltd trading as EE-Oz Training Standards (www.ee-oz.com.au)

***Occupational health
and safety
requirements***

A safe and healthy environment will be provided for students and teachers as well as the particular safety procedures followed as part of the learning / teaching activity and content.